Claims

1. A power supply system for powering an electric motor in an electric vehicle, the system comprising:

a generator for converting a fuel to electricity,

a metal-air converter electrically coupled to the electric motor and the generator for receiving electricity produced by the generator, and

a fuel supply for supplying fuel to the generator.

2. The power supply system of claim 1, wherein the metal-air converter comprises one of a zinc-air battery, an aluminum-air battery, a magnesium-air battery, a lithium-air battery, a calcium-air battery and an iron-air battery.

3. The power supply system of claim 1, wherein said metal-air converter is adapted to be operated:

as a rechargeable battery for receiving electricity from the generator;

as a rechargeable battery for receiving electricity from an off board electric source; and

as a fuel cell with replenished metal fuel.

4. The power supply system of claim 1, wherein the generator is selected from a group consisting of a fuel cell, a combustion engine, a gas turbine, and combinations thereof.

5. The power supply system of claim 1, wherein the generator comprises a hybrid power source including a gas turbine and a fuel cell.

6. The power supply system of claim 4, wherein said fuel cell is selected from a group including solid oxide, solid state, molten carbonate, phosphoric acid and alkaline and proton electrolyte membrane fuel cells.

7. The power supply system of claim 1, wherein the metal-air converter has an energy density greater than 200 Wh/kg or 500 Wh/l and power density greater than 200 W/kg or 500 W/l.

8. The power supply system of claim 1, wherein the generator produces power in excess of the needs for metal-air converter recharging or on board use and can offer power for off board use.

9. A method of charging a metal-air converter in an electrically-powered vehicle, comprising the steps of:

producing electricity using an on-board generator, and

applying the electricity from the generator to the metal-air converter to convert a metal oxide produced by the metal-air converter to a metal fuel.

10. The method of claim 9, wherein the metal-air converter powers an electric motor on the electrically-powered vehicle.

11. The method of claim 9, wherein the step of producing electricity comprises electrochemically converting a generator fuel to electricity.

12. The method of claim 11, further comprising the step of supplying the generator fuel to the generator.

13. The method of claim 9, further comprising the step of receiving a supply of the metal fuel from an off-board source.

14. A vehicle propulsion system for an electric vehicle, comprising:

an electric motor for driving a vehicle drive train of the electric vehicle;

a metal-air converter coupled to the motor for powering the motor; and

a generator coupled to the metal-air converter for recharging the metal-air converter and for providing power to the motor, wherein the electric motor, the metal-air converter and the generator are interconnected.

15. The vehicle propulsion system of claim 14, wherein the metal-air converter comprises one of a zinc-air battery, an aluminum-air battery, a magnesium-air battery, a lithium-air battery, a calcium-air battery and an iron-air battery.

16. The power supply system of claim 14, wherein the generator is selected from a group consisting of a fuel cell, a combustion engine, and a gas turbine.

17. The power supply system of claim 14, wherein the generator comprises a hybrid power source including a gas turbine and a fuel cell.

18. The power supply system of claim 16, wherein said fuel cell is selected from a group including solid oxide, solid state, molten carbonate, phosphoric acid and alkaline and proton electrolyte membrane fuel cells.

19. A method of propelling a vehicle, comprising the steps of:

converting a metal fuel to a metal oxide, wherein the step of converting the metal fuel releases electrons to produce electricity;

applying the electricity to an electric motor to drive a motor vehicle drive train; and

reconverting back at least a portion of said metal oxide to metal fuel by applying an electric charge from an on-board generator to the metal oxide.

20. The method of claim 19, wherein the metal fuel comprises one of zinc, aluminum, magnesium, lithium, calcium and iron.

21. The method of claim 19 further comprising the step of supplying a generator fuel to the on-board generator, wherein the generator converts the generator fuel to the electric charge.

22. An electrically-powered vehicle, comprising:

a motor for driving the vehicle; and

a metal-air converter powered by an on-board energy source for powering the motor,

wherein the vehicle can travel a distance of more than three hundred miles before requiring recharging of the battery from an off-board source.

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23. The vehicle of claim 22, wherein the on-board energy source comprises a generator and a fuel supply.

24. The vehicle of claim 24, wherein the generator is selected from a group consisting of a fuel cell, a combustion engine, a gas turbine and combinations thereof.